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User's Guide



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**Series FTB-1400-MD-A-LP
FTB-1400-SD-A-LP
FTB-1400-RD-A-LP**

Flow Monitor - Advanced Version



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WARNING: These products are not designed for use in, and should not be used for, human applications.

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INTRODUCTION

The FTB-1400 Flow Monitor is a state-of-the-art, digital signal processing flow monitor, designed to provide the user with exceptional flexibility at a very affordable price. Though designed for use with Omega FTB-1400 flow meters, this display can be used with almost any flow meter producing a low amplitude AC output or contact closure signal(s).

This flow monitor is capable of accepting a low-level frequency input for calculating flow rate and total. These calculations can then be displayed in the desired units of measurement. All FTB-1400 flow monitors come pre-calibrated, from the factory, if ordered with an Omega FTB-1400 Flow Meter. If required, however, it can easily be re-configured in the field. The monitor's large 8 digit by .75" numeric liquid crystal display makes extended range viewing practical. The second 8 digit by .38" alphanumeric display provides for selectable units viewing in run mode and prompts for variables in program mode. Finally, the user can choose between displaying rate, total, or alternating between both rate and total.

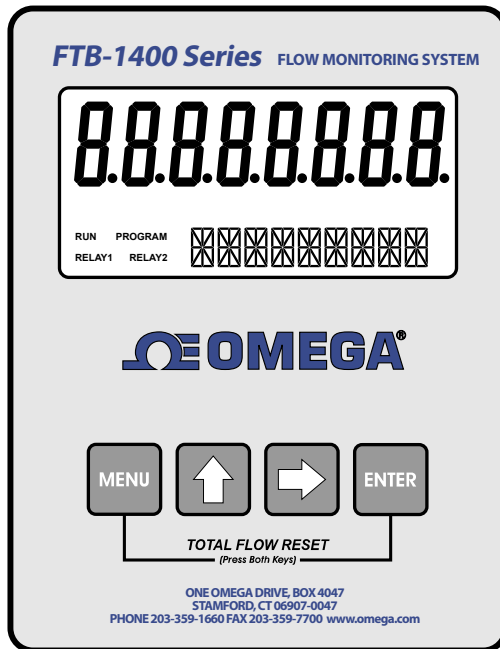


Figure 1: Flow Monitor Face

FEATURES

- Displays Rate and/or Total
- Large 0.75 Inch, 8 Digit Display for Easy Viewing
- Simple, Front Panel Programming
- Various Mounting Styles Available
- 10 Point Linearization Capability
- Gas Measurement Software Included
- NEMA 4X Suitable for Outdoor Mounting
- Intrinsically Safe
- Microprocessor Based, Low Power Components
- 4-20 mA Loop Powered
- Automatic Decimal Point Locating
- Lead Zero Blinking
- Surface Mount Technology Use Throughout

SPECIFICATIONS

Power Supply:

4-20 mA loop power

Power Consumption:

25 mA (maximum)

Alphanumeric Rate and Total Display:

8 digit, .75" high numeric display

8 character, .38" high alphanumeric display

Fixed or toggle modes of operation for flow rate and totalizer display

Pulsed Output Signal:

Outputs one pulse for each increment of the least significant totalizer digit

Max. Voltage: 30 Vdc

Pulse Type: Opto-Isolated open collector transistor

Pulse Width ON State: 0.9 V drop @ 5.0 mA or 0.7 V drop @ 0.1 A

Magnetic Pick-up Inputs:

Frequency Range: 0 to 3500 Hz

Trigger Sensitivity: 30 mV p-p

Over Voltage Protected: ± 30 VDC

Frequency Measurement Accuracy: $\pm 0.1\%$ **Temperature Drift:** 50 ppm / °C (max)**Transient Overvoltages:** Category 3, in accordance with IEC664**Pollution Degree:** 2, in accordance with IEC664**Mounting Classification:**

Meter Mount: NEMA 4X Enclosure

Remote Mount: NEMA 4X Enclosure

Swivel Mount: NEMA 4X Enclosure

Environmental:

Operating Temperature: -22 °F to +158 °F (-30 °C to +70 °C)

Humidity: 0-90% Non-condensing

Units of Measure:

Gallons, Oil Barrels, Liters, Cubic Meters, MGal, Cubic FT, MCF, MMCF
Megltrs, Acre FT, Liq. Barrels, LBS, KGS

Time Intervals: Day, Hour, Minute, Second

OPERATING THE MONITOR

The monitor has two modes of operation referred to as the **RUN** mode and the **PROGRAM** mode. Both the run mode and the program mode display screen enunciators confirming the state of the monitor. A quick glance at the lower left hand corner of the LCD screen will confirm operating status. Normal operation will be in the **RUN** mode. To access the program mode, press the **MENU** button until the first programming screen is displayed. After programming the display with the necessary information, a lock out feature can be turned on to prevent unauthorized access or changing the meter's setup parameters.

BASIC PROGRAMMING MODE

Keys:

MENU – Switch between RUN and PROGRAM modes

UP Arrow – Scrolls through programming sub-menus in forward direction and increments numeric variables

RIGHT Arrow – Scrolls through programming sub-menus in reverse direction and moves the active digit to the right

ENTER – Used to enter sub-menus, save programming information and in the reset process

If your monitor was ordered with an Omega flow meter, the two components ship from the factory calibrated as a set. If the monitor is a replacement, the turbine's K-factor has changed, or the monitor is being used with some other pulse generating device, programming will be necessary.

ADVANCED PROGRAMMING MODE

PROGRAMMING

EACH TURBINE FLOW METER IS SHIPPED WITH EITHER A K-FACTOR VALUE OR FREQUENCY DATA. IF FREQUENCY DATA IS PROVIDED, THE DATA MUST BE CONVERTED TO A K-FACTOR BEFORE PROGRAMMING; OTHERWISE, 10 POINT LINEARIZATION MUST BE USED TO PROGRAM THE MONITOR. K-FACTOR INFORMATION, WHEN SUPPLIED, CAN USUALLY BE FOUND ON THE NECK OF THE FLOW METER OR STAMPED ON THE BODY. THE K-FACTOR REPRESENTS THE NUMBER OF PULSES PER UNIT OF VOLUME. THE K-FACTOR WILL BE NEEDED TO PROGRAM THE MONITOR READOUT.

ENTER PROGRAM MODE – Change to program mode by pressing the MENU button once. The mode indicator will change from RUN to PROGRAM.

NOTE: If any input value exceeds the meter's capabilities for that particular parameter, the LIMIT indicator will begin to flash indicating an invalid entry. Press ENTER once to return to the parameter's entry screen to reenter the value.

SELECT THE METER SIZE – At the METER prompt, press the ENTER button once. The current meter size number will begin to flash. Using the arrow keys, scroll through the size choices until you find the bore size of your meter. Press ENTER once to save the meter size choice.

NOTE: The meter connection size and the bore size are different. For example, many of the 1" NPT turbines have bore sizes that range from $\frac{3}{8}$ " up to 1". Be sure to use the correct bore size or the meter will report incorrect flows and totals.

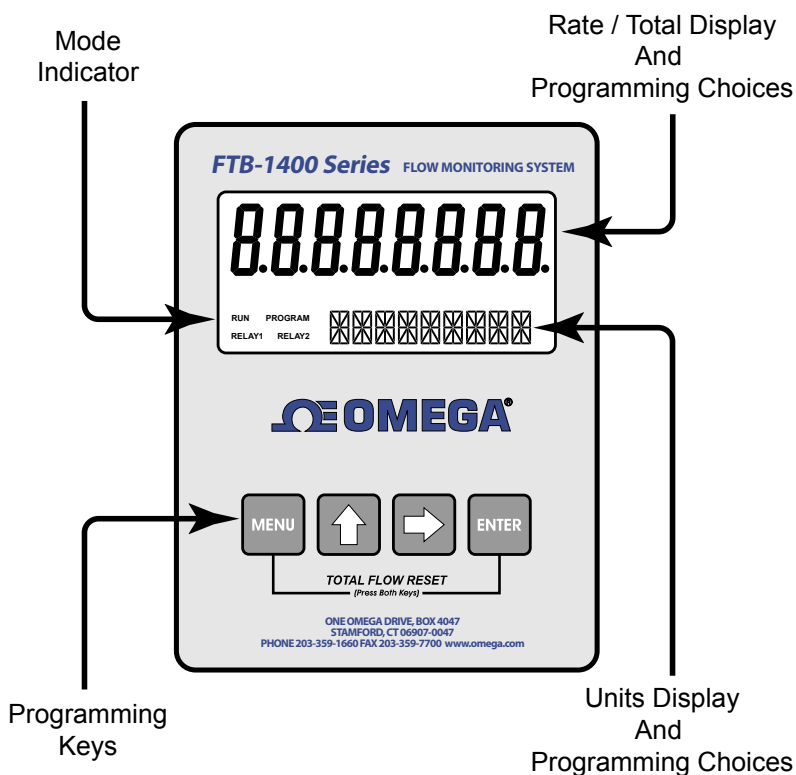


Figure 2: Flow Monitor Controls

SELECT THE DISPLAY FUNCTION – The monitor can display RATE or TOTAL or alternate between BOTH rate and total. At the DISPLAY prompt, press the ENTER key once. The monitor now shows the display mode currently in effect. If the current selection is correct, press the ENTER key to advance to the next parameter. To change to an alternate display mode, use the arrow keys to scroll to the desired display mode and press ENTER to save the choice.

SELECT THE RATE UNITS OF MEASURE – The monitor allows the choice of many common rate units. (See Specifications for a complete listing of the unit choices.) At the RATE UNT prompt, press the ENTER key once. The monitor now shows the rate units of measure the display is currently set for. If the current selection is correct, press the ENTER key to advance to the next parameter. To change to an alternate unit, use the arrow keys to scroll to the desired rate unit and press ENTER to save the choice.

SELECT THE RATE [TIME] INTERVAL – The term Rate implies that something is occurring over a period of time. Most people are familiar with the rate of speed of a car reported in miles per hour (MPH). The same concept holds true for a flow meter. The time choices are SEC (seconds), MIN (minutes), HOUR (hours), and DAY (days). At the RATE INT prompt, press the ENTER key once. The monitor now shows the time interval the display is currently set for. If the current selection is correct, press the ENTER key to advance to the next parameter. To change to an alternate time interval, use the arrow keys to scroll to the desired time interval and press ENTER to save the choice.

NOTE: *If flow rate is the only measurement of interest, skip to KFAC UNT to complete the programming process.*

SELECT THE TOTAL UNITS OF MEASURE – If a flow amount is desirable, the units for the total must first be chosen. The monitor allows the choice of many common totalization units. (See Specifications for a complete listing.) At the TOTL UNT prompt, press the ENTER key once. The monitor now shows the total units of measure the display is currently set for. If the current selection is correct, press the ENTER key to advance to the next parameter. To change to an alternate unit, use the arrow keys to scroll to the desired totalization unit and press ENTER to save the choice.

NOTE: *This unit of measure does not have to reflect the rate unit you have previously chosen.*

(Example: Rate Units = Gallons, Total Units = Barrels).

SELECT THE TOTAL'S DISPLAY MULTIPLIER – The monitor has a very versatile display that has the ability to accumulate the flow total in multiples of ten. For example, if the most desirable totalization unit is 1,000 gallons, the monitor can easily be set up for this requirement. Once the unit is back in RUN mode, every time the total display is incremented by one digit the actual total would be an additional 1,000 gallons. At 1,000 gallons the total display would read 1, at 3,000 gallons the total display would read 3, etc. This feature eliminates having to look at a total, counting the digits and mentally inserting commas for each 1000 multiple.

At the TOTL MUL [Multiple] prompt, press the ENTER key once. The monitor now shows the multiplier the total display is currently set for. If the current selection is correct, press the ENTER key to advance to the next parameter. To change to an alternate multiplier, use the arrow keys to scroll to the desired multiplier unit and press ENTER to save the choice.

Multiplier Choices – 0.01, 0.1, 1, 10, 100, 1000, 10000, 100000, and 1000000 Units.

NOTE: *Unless otherwise specified, Omega FTB-1400 turbine flow meters are supplied with K-factors measured in pulses per gallon (PUL/GAL).*

ENTER THE METER'S K-FACTOR UNIT – Directly after the METER size is selected, the display's K-factor unit must be chosen. Use the UP arrow key to select your K-factor unit. For meters calibrated in gallons, use PUL/GAL (pulses per gallon); for meters calibrated in cubic meters, use PUL/M3 (pulses per cubic meter), etc. Press ENTER to save the K-factor unit and advance to the next parameter.

SCALE FACTOR – At the SCALE F prompt, press the ENTER key once. The current Scale Factor will begin to flash. If the current selection is correct, press the ENTER key to advance to the next parameter. The scale factor is used to force a global change to all variables. For example, under operating conditions the display is reading a consistent 3% below the expected values at all flow rates. Rather than changing all parameters individually, the scale factor can be used to compensate

for the 3% offset. The scale factor would be set to 1.03 to correct the readings. The range of scale factors is from 0.5 to 1.5. The default scale factor is 1.00.

METER TYPE – At the METERTYP prompt, press the ENTER key once. The current meter type will be displayed as “Liquid” or “GAS”. If the current selection is correct, press the ENTER key to advance to the next parameter. If “GAS” is selected you must then enter your Operating Pressure and Operating Temperature before advancing to the next parameter.

DAMPING FACTOR – At the DAMPING prompt, press the ENTER key once. The current Damping setting will begin to flash. If the current selection is correct, press the ENTER key to advance to the next parameter. The Damping Factor is increased to enhance the stability of the flow readings. Damping values are decreased to allow the flow meter to react faster to changing values of flow. This parameter can take on any value between 0 and 99 with 0 being the default.

TOTALIZER PULSE OUTPUT – The pulse output parameter can be either enabled or disabled. When enabled this output generates 20 mS duration pulse for every time the least significant digit of the totalizer increments (20 Hz Max). The amplitude of the pulse is dependent on the voltage level of the supply connected to the pulse output and is limited to a maximum 30 VDC.

FLOW 4 mA SETTING – When the loop powered option is ordered, the flow rate that corresponds to 4 mA must be set. If the current selection is correct, press the RIGHT arrow key once to advance to the next parameter. If adjustment is required, press the ENTER key once at the FLOW 4MA prompt. The most significant digit will begin to flash. The RIGHT arrow key moves the active digit one place to the right for each press of the key. The UP arrow key increments the active digit one integer for each press of the key. When the correct 4 mA flow rate has been entered, press ENTER once to store this value and move to the next parameter.

FLOW 20 mA SETTING – Follow the same programming process as the FLOW 4MA except for the flow rate setting. In this case, use the maximum flow rate for the meter.

4-20 mA CALIBRATION – When ordered with a 4-20 mA option, this menu item allows the fine adjustment of the 4-20 mA output. The 4 mA setting is typically between 35 and 50. To set the 4 mA value, connect an ammeter in series with the loop power supply. See **Figure 3**. At the 4-20CAL prompt, press ENTER once. The display will now show a steady NO indication. Press the UP arrow key to change to a flashing YES display. Press ENTER once to access the 4 mA fine adjustment.

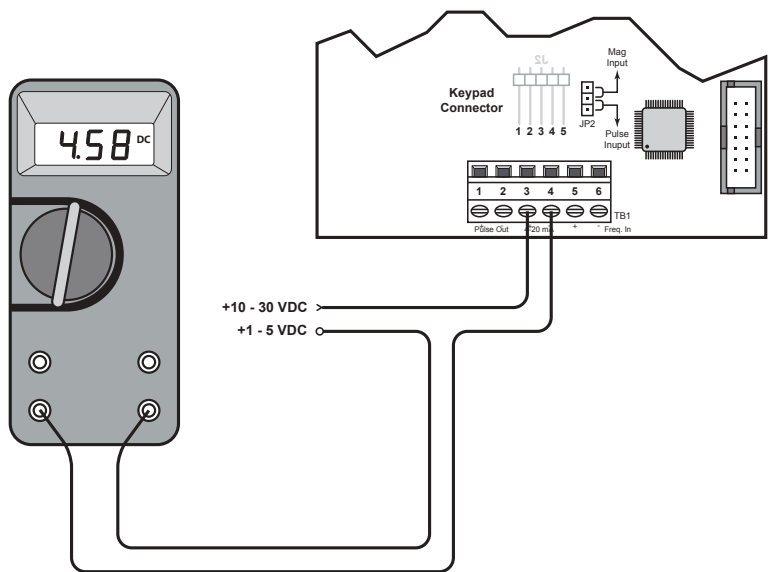


Figure 3: Typical Ammeter Connection

4 mA ADJUSTMENT – While monitoring the ammeter, adjust the 4 mA value to obtain a 4 mA reading. The UP arrow key increments the value and the RIGHT arrow key decrements the value. When a steady 4 mA reading is obtained on the ammeter, press the ENTER key to lock in this value and move to the 20 mA adjustment.

20 mA ADJUSTMENT – The 20 mA adjustment is performed using the same procedure as the 4 mA adjustment. While monitoring the ammeter, adjust the 20 mA value to obtain a 20 mA reading. The UP arrow key increments the value and the RIGHT arrow key decrements the value. When a steady 20 mA reading is obtained on the ammeter, press the ENTER key to lock in this value and move to the next parameter.

4-20 mA TEST – The monitor contains a diagnostic routine that allows the simulation of mA values between 4 and 20 to check output tracking. At the 4-20TEST prompt, the arrow keys change the simulated mA output in increments of 1 mA. The ammeter should track the simulated mA output. If a 4-20 mA test is not necessary, press the ENTER key once to move to the next parameter.

LINEARIZATION

Enhanced accuracy can be obtained by linearization of the display. The linearization routine will accept a maximum of ten points. Linearization requires additional calibration data from the meter to be used with the monitor. Typically, calibration information can be obtained in three, five, and ten points from the flow meter's manufacturer. If linearization is not needed, pressing the RIGHT arrow key will take you to the next parameter

Number of Points – At the LINEAR prompt, press ENTER once. The NUM PTS number will be displayed. Press ENTER to set the number of points you wish to use. Again, the **UP** arrow key increments the value and the **RIGHT** arrow moves the cursor between digits. When the number of points has been input, press the ENTER key once to move to the first linear segment.

Press the ENTER key once and the first linear point's frequency input will begin to flash (FREQ 1). Enter the frequency for the first linear point using the arrow keys. When the frequency value input has been completed, press ENTER once again to change to the coefficient value for the first linear point.

The coefficient is the value applied to the nominal K-factor to correct it to the exact K-factor for that point. The coefficient is calculated by dividing the actual K-factor for that point by the average K-factor for the flow meter.

$$\text{Coefficient} = \text{Actual K-factor} \div \text{Average K-factor}$$

At the COEFF prompt, enter the coefficient that corresponds to the frequency value previously entered. Press ENTER once to move to the next scaling point.

Continue entering pairs of frequency and coefficient points until all data has been entered. Press the MENU key twice at the NUM PTS prompts to exit to the LINEAR prompt. Press the RIGHT arrow key to move to the next parameter.

PASSWORD

Password protection prevents unauthorized users from changing programming information. Initially, the password is set to all zeros. To change the password, press ENTER once at the password prompt. The first digit of the password value will begin to flash. Using the arrow keys as previously described, enter the password value. Pressing ENTER once will store the password and take you back to the RST PSWD screen.

NOTE: *This password will allow the operator to manually reset totals.*

RST PSWD – Reset Password protection prevents unauthorized users from manually resetting the flow monitor's accumulated totals. Initially, the password is set to all zeros. To change the password, press ENTER once at the password prompt. The first digit of the password value will begin to flash. Using the arrow keys as previously described, enter the password value. Pressing ENTER once will store the password and take you back to the METER size screen, pressing MENU exits the program mode. The FTB-1400 Flow Monitor is now ready for use with its companion meter. Note: Entering a password in the Password screen and leaving the password blank in the RST PSWD screen would allow for total resets (not requiring password) and restrict programming modification.

RESET TOTAL – To reset the monitor total display, in run mode press the MENU and ENTER simultaneously until TOTAL RST starts to flash. The TOTAL RST will stop flashing and the display will return to the run mode at the conclusion of the procedure.

STORE TOTAL – The current total can be manually stored in the monitor's flash memory. This procedure may be desirable prior to changing the settings or replacing the battery. Press and hold the ENTER key for 2 seconds. The display will respond with a flashing TOTALSVD and then return to the run mode.

AUTOMATIC STORE TOTAL – The monitor is equipped with a store total feature that works automatically, saving the current total to flash memory once per hour and just before a low battery condition turns the unit off.

ADDITIONAL INPUT OPTIONS

The FTB-1400 Flow Monitor is capable of receiving magnetic pick-up input (small signal sine wave) or a contact closure input (pulse). Since Omega FTB-1400 Flow Meters utilize a magnetic pick-up, the monitor is shipped configured for magnetic pick-up input. To change to a contact closure input, remove JP2 from the top two pins and jumper them to the bottom two pins. See **Figure 4**.

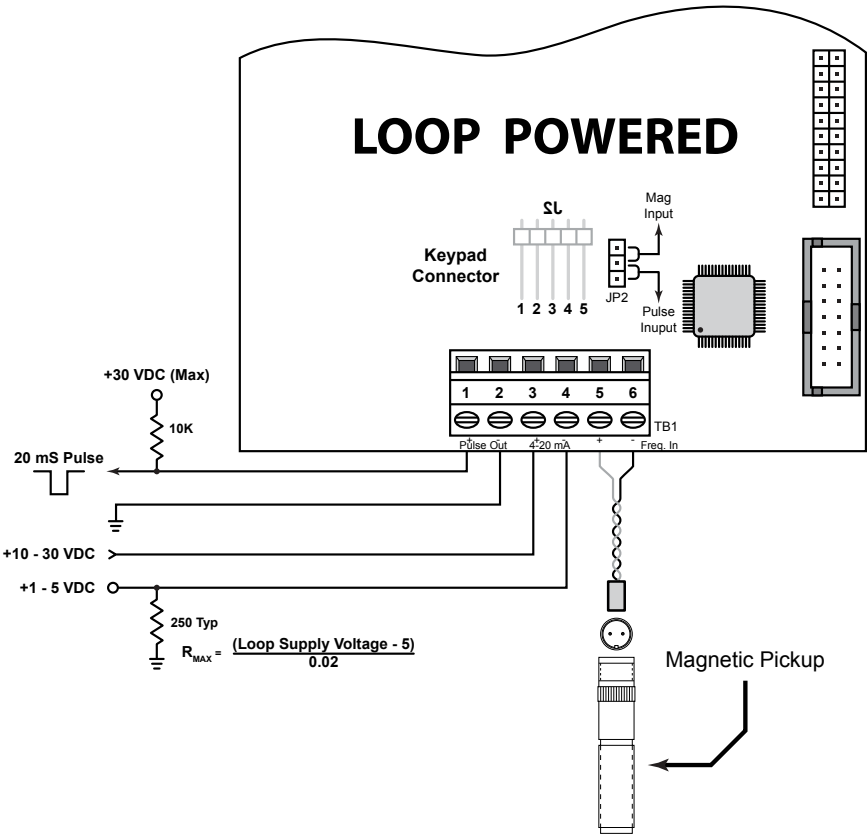


Figure 4: Wiring Diagram

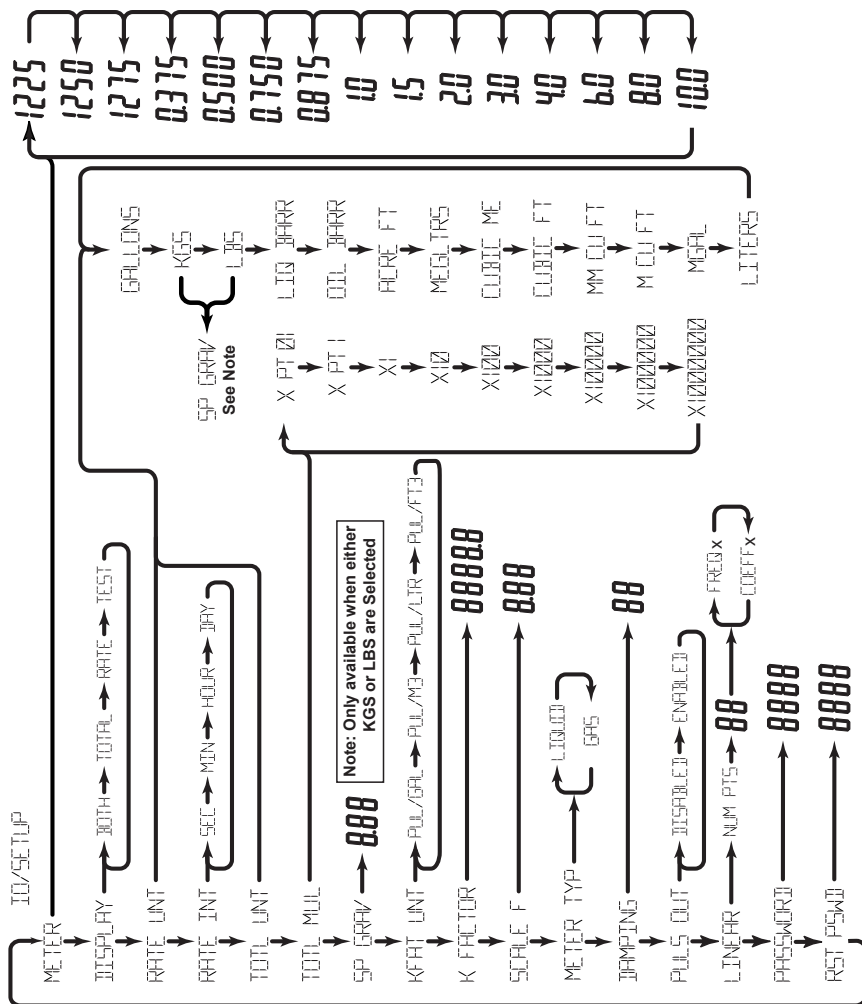


Figure 5: Basic Programming Menu

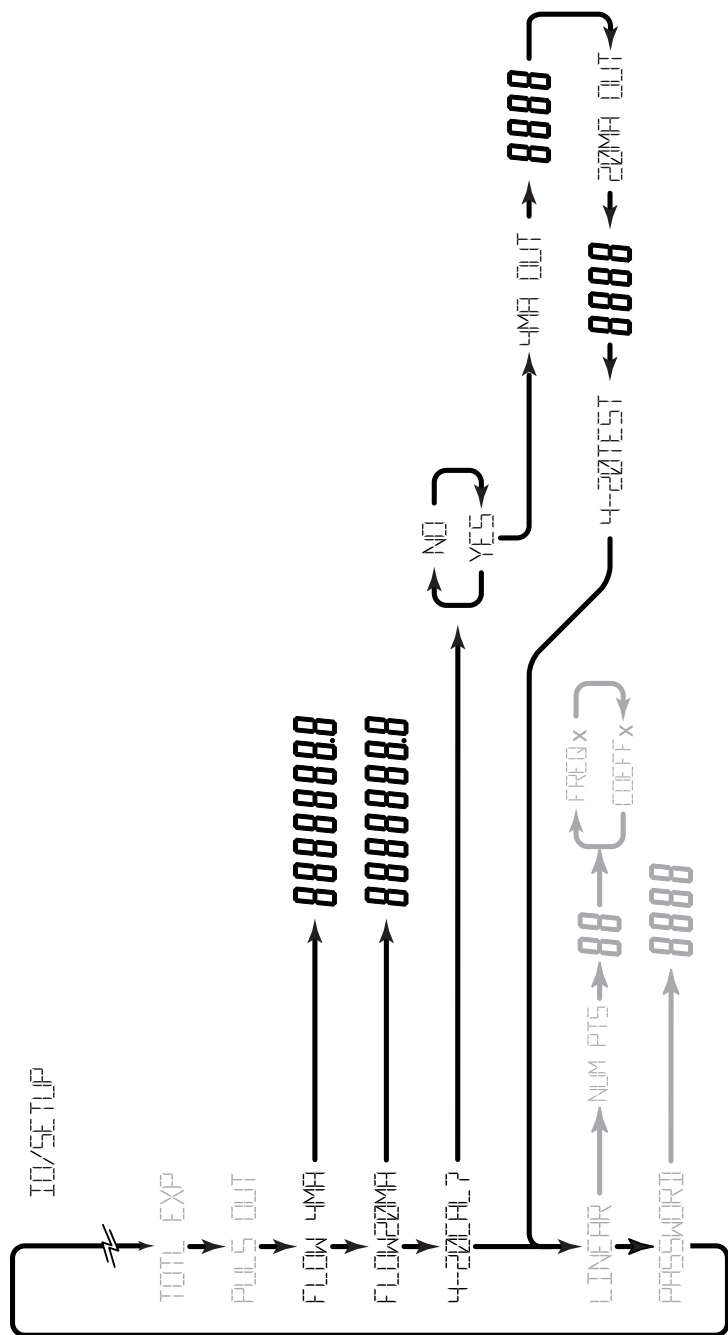
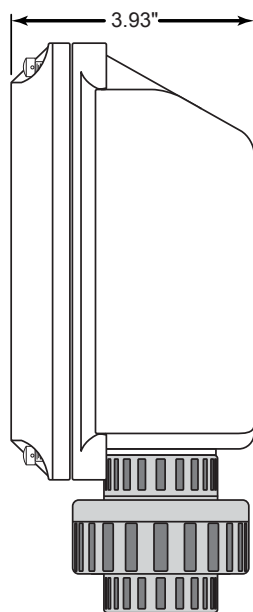
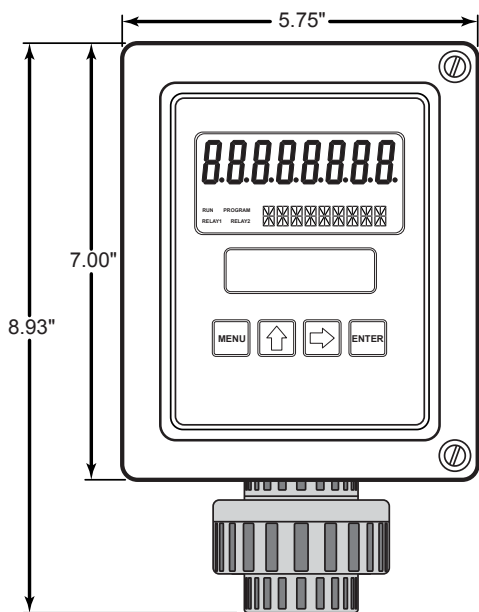
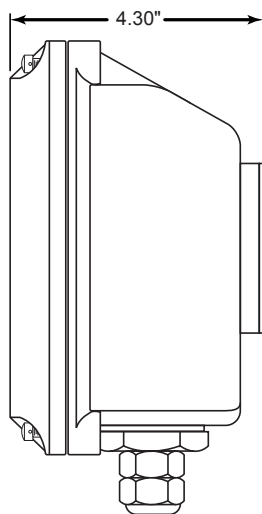
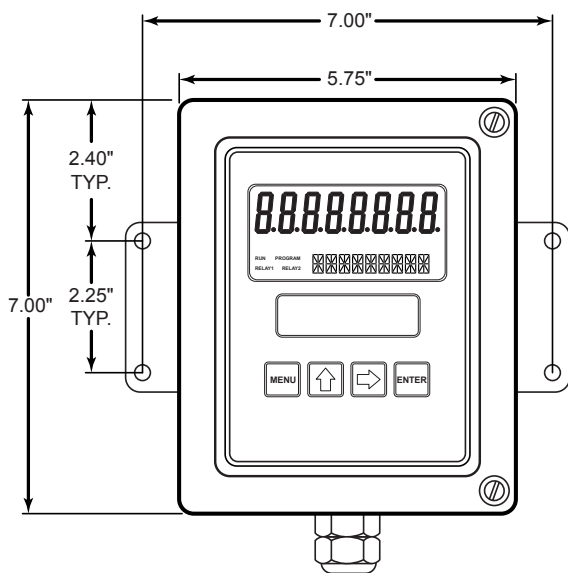


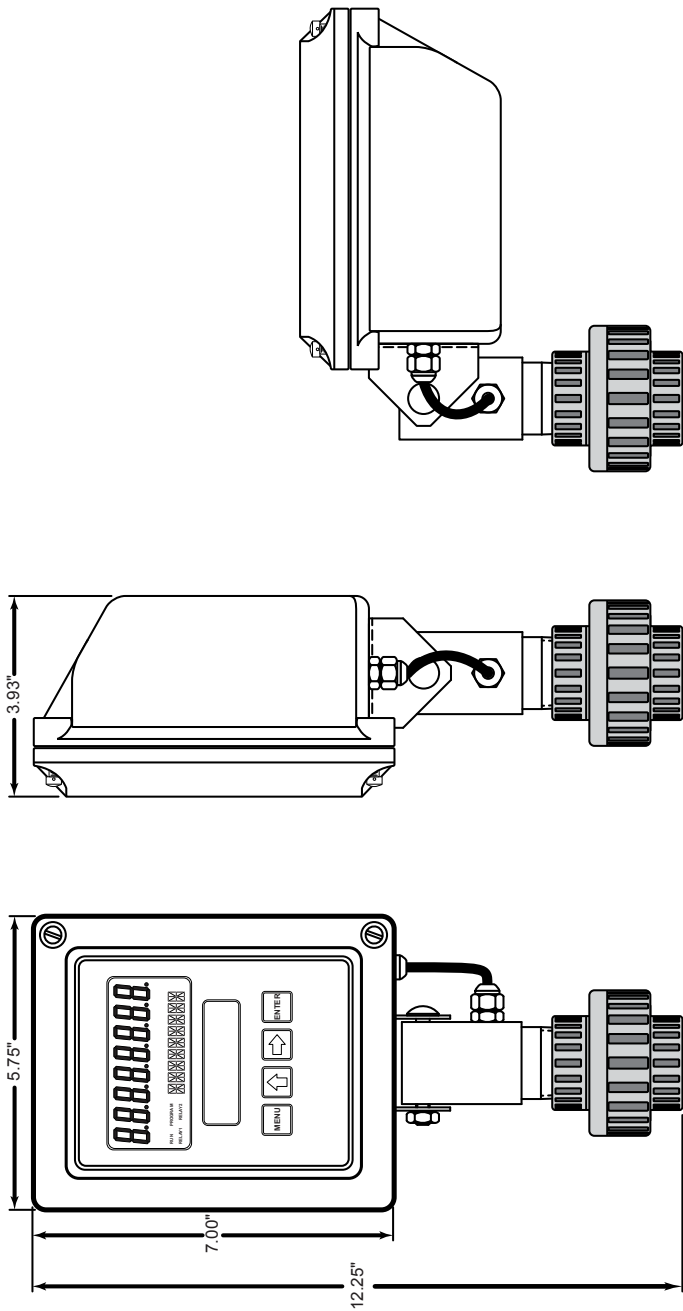
Figure 6: 4-20 mA Programming Menu



METER DISPLAY



REMOTE DISPLAY



SWIVEL MOUNT
Figure 7: MOUNTING OPTIONS

ADDITIONAL SCALING PARAMETERS

This information is supplied as a general introduction to the basic concepts used to scale rate displays. The applicability of the information is dependent on the type and capabilities of the specific display/monitor used.

Flow meters producing an electronic signal are normally supplied in one of two output formats. The pulse format generates some form of alternating signal that can be “raw”, that is no amplification or wave shaping can be done prior to transmission to the readout. The output pulse rate is related proportionally to flow rate. Pulses can also be modified to produce higher output amplitudes or specific wave shapes.

The other output format is an analog signal. This is a continuous, variable voltage or current signal that is normally scaled to the dynamic range of the meter. Typical analog signals are 0-5 Vdc, 0-10 Vdc, and 4-20 mA. The analog signals may or may not be derived from a raw pulse signal produced by the flow meter.

Scaling for any of these input signals always requires at least two scaling points for a linear process - zero or minimum flow point and the maximum flow point. Additionally, each scaling point has two components, the actual input signal value and the desired display value at that input signal for that scaling point.

For example, a pulse output flow meter has a flow of 50 GPM at a pulse rate of 100 Hz. The actual input signal is the 100 Hz figure, but allowing the display to read “100” would be meaningless to the operator. The solution to this problem is to “scale” the display to “read” 50 (GPM) when the input is 100 Hz.

PULSE OUTPUT SIGNALS FOR LINEAR PROCESSES (WHERE LINEARIZATION IS NOT NECESSARY)

Pulse output signals are related to flow rate by a constant, usually referred to as the “K-factor”. The K-factor is reported as the number of accumulated pulses that represents a particular volume such as gallon or liter. K-factors are indicated in pulses per unit volume or counts per unit volume. An example of a K-factor, normally supplied by the manufacturer, might be 2000 counts per gallon. The K-factor is correlated to flow through a simple mathematical relationship:

$$\text{Frequency} = \text{K-factor} \times \text{Volume per unit of time} \div 60$$

Using the previous example of 2000 counts per gallon and further assuming this meter has a maximum flow rate of 25 GPM, the formula can be arranged to calculate the input frequency required for a scaling point as follows:

$$\text{Frequency} = 2000 \times 1 \text{ (gal)} \div 60 = 33.333 \text{ Hz at 1 GPM}$$

Given that the meter has a maximum flow rate of 25 GPM, the maximum frequency would then be:

$$\text{Frequency} = 2000 \times 25 \text{ (gal)} \div 60 = 833.333 \text{ Hz at 25 GPM}$$

A programmable display requires at least two points. The first point is the zero or minimum flow and the second is normally the maximum flow rate. For the imaginary flow meter used in the example above, the scaling would be as follows:

Input Value for Scaling Point 1	=	0
Display Value for Scaling Point 1	=	0
Input Value for Scaling Point 2	=	833.33
Display Value for Scaling Point 2	=	25

PULSE OUTPUT SIGNALS FOR NON-LINEAR PROCESSES (APPLICATIONS THAT CAN BENEFIT FROM LINEARIZATION)

Few flow meters actually behave in a linear way. There is always some uncertainty about the “exact” flow at a given reported input value. For many common flow measurement applications, the assumption of linear flow is adequate for the process being measured. When higher accuracy is required, a technique called “Linearization” is often employed.

When the flow meter is being calibrated, multiple data points are obtained for the particular meter being tested. A typical five point calibration run is displayed below.

GPM	AVG Frequency	** UUT Hz Counts/GAL	UUT K(Hz×60)÷NK GPM	Error %FS
15.00	769.7	3078.59	14.90	-0.65
9.06	466.1	3086.75	9.03	-0.38
5.49	285.2	3118.64	5.52	0.65
3.32	171.7	3103.95	3.32	0.17
2.00	103.6	3101.80	2.01	0.10

*** UUT = Unit Under Test*

If this meter produced an actual linear output, the K-factor calculation for the Unit Under Test would be exactly the same for each measurement point. Inspection of the UUT K in the example provided shows that this is not the case and indicates that this meter is not a perfectly linear device.

Many programmable displays allow for linearization and can provide a better match of the displayed flow values with the actual flow values by incorporating more measurement points. In the example, the unit would be programmed for six points, the five data points and a zero point, and use pairs of input values to accomplish the linearization.

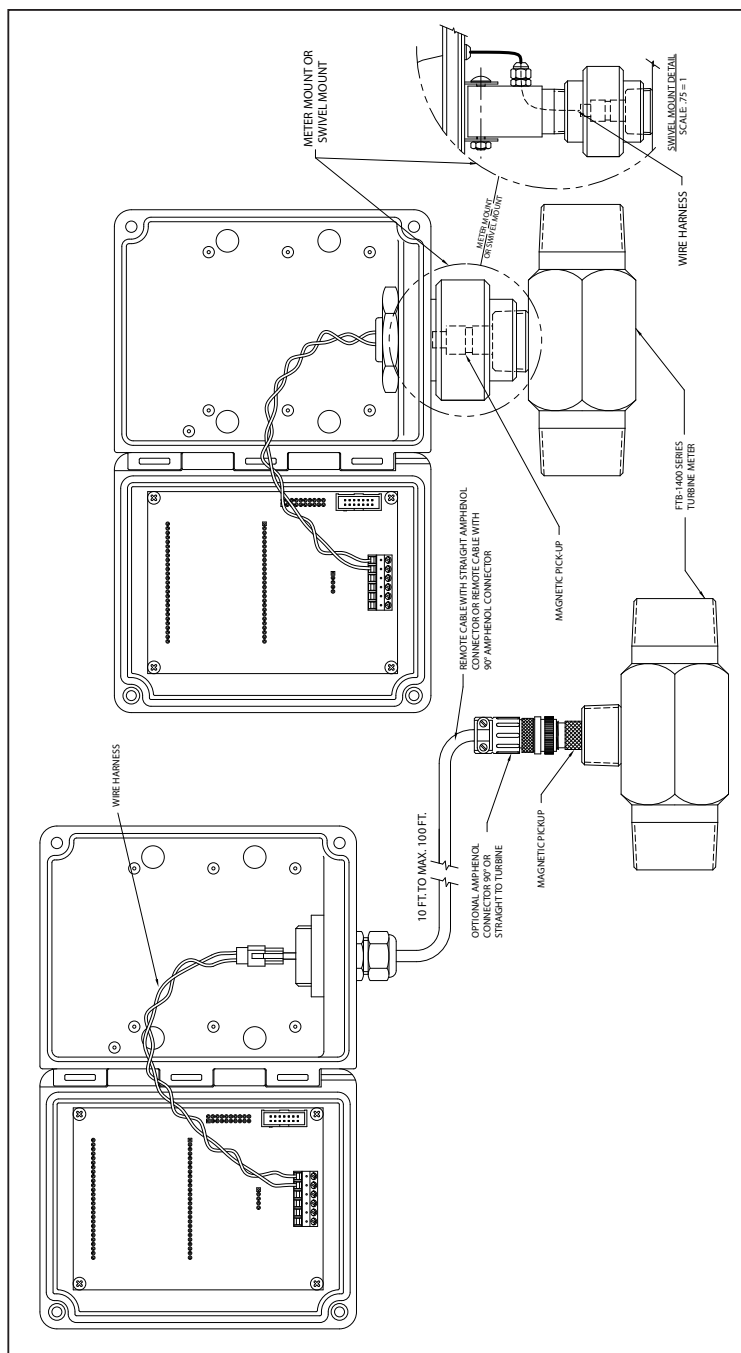


Figure 8: Installation Drawing

TROUBLESHOOTING GUIDE

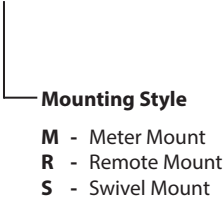
Trouble	Remedy
No LCD Display	<ul style="list-style-type: none"> • Check power supply voltage. Should be between 10 and 30 Vdc.
No Rate or Total Displayed	<ul style="list-style-type: none"> • Check connection from meter pick-up to display input terminals. • Check turbine meter rotor for debris. Rotor should spin freely. • Check programming of flow monitor.
Flow Rate Display Interprets Reading Constantly	<ul style="list-style-type: none"> • This is usually an indication of external noise. Keep all AC wires separate from DC wires. • Check for large motors close to the meter pick-up. • Check for radio antenna in close proximity. • Try disconnecting the pick-up from the monitor pig tail. This should stop the noise.
Flow Rate Indicator Bounces	<ul style="list-style-type: none"> • This usually indicates a weak signal. Replace pick-up and/or check all connections. • Examine K-factor.

DEFAULT K-FACTOR VALUES

Meter Size	Default K-factor	Lower Limit	Upper Limit
0.375	20,000	16,000	24,000
0.500	13,000	10,400	15,600
0.750	2,750	2,200	3,300
0.875	2,686	2,148	3,223
1.000	870.0	696.0	1,044
1.500	330.0	264.0	396.0
2.000	52.0	41.6	62.0
3.000	57.0	45.6	68.0
4.000	29.0	23.2	35.0
6.000	7.0	5.6	8.0
8.000	3.0	2.4	4.0
10.000	1.6	1.3	2.0

PART NUMBERING

FTB-1400-XD-A-LP



REPLACEMENT PARTS

Component	Part Number
Keypad	B260713
Pick-up Cable	B222-121
Desiccant Bag	B260630
PVC Union	B220016
PVC Reducer Bushing	B220056
Rubber Washer	B228207
Steel Lock Washer	B220018
PCB Shield (battery units)	B280603
Desiccant Shield	B280680
Cord Grip	B220103

NOTES



WARRANTY/DISCLAIMER

OMEGA ENGINEERING, INC. warrants this unit to be free of defects in materials and workmanship for a period of **13 months** from date of purchase. OMEGA's WARRANTY adds an additional one (1) month grace period to the normal **one (1) year product warranty** to cover handling and shipping time. This ensures that OMEGA's customers receive maximum coverage on each product.

If the unit malfunctions, it must be returned to the factory for evaluation. OMEGA's Customer Service Department will issue an Authorized Return (AR) number immediately upon phone or written request. Upon examination by OMEGA, if the unit is found to be defective, it will be repaired or replaced at no charge. OMEGA's WARRANTY does not apply to defects resulting from any action of the purchaser, including but not limited to mishandling, improper interfacing, operation outside of design limits, improper repair, or unauthorized modification. This WARRANTY is VOID if the unit shows evidence of having been tampered with or shows evidence of having been damaged as a result of excessive corrosion; or current, heat, moisture or vibration; improper specification; misapplication; misuse or other operating conditions outside of OMEGA's control. Components in which wear is not warranted, include but are not limited to contact points, fuses, and triacs.

OMEGA is pleased to offer suggestions on the use of its various products. However, OMEGA neither assumes responsibility for any omissions or errors nor assumes liability for any damages that result from the use of its products in accordance with information provided by OMEGA, either verbal or written. OMEGA warrants only that the parts manufactured by the company will be as specified and free of defects. OMEGA MAKES NO OTHER WARRANTIES OR REPRESENTATIONS OF ANY KIND WHATSOEVER, EXPRESSED OR IMPLIED, EXCEPT THAT OF TITLE, AND ALL IMPLIED WARRANTIES INCLUDING ANY WARRANTY OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE HEREBY DISCLAIMED. LIMITATION OF LIABILITY: The remedies of purchaser set forth herein are exclusive, and the total liability of OMEGA with respect to this order, whether based on contract, warranty, negligence, indemnification, strict liability or otherwise, shall not exceed the purchase price of the component upon which liability is based. In no event shall OMEGA be liable for consequential, incidental or special damages.

CONDITIONS: Equipment sold by OMEGA is not intended to be used, nor shall it be used: (1) as a "Basic Component" under 10 CFR 21 (NRC), used in or with any nuclear installation or activity; or (2) in medical applications or used on humans. Should any Product(s) be used in or with any nuclear installation or activity, medical application, used on humans, or misused in any way, OMEGA assumes no responsibility as set forth in our basic WARRANTY/DISCLAIMER language, and, additionally, purchaser will indemnify OMEGA and hold OMEGA harmless from any liability or damage whatsoever arising out of the use of the Product(s) in such a manner.

RETURN REQUESTS/INQUIRIES

Direct all warranty and repair requests/inquiries to the OMEGA Customer Service Department. BEFORE RETURNING ANY PRODUCT(S) TO OMEGA, PURCHASER MUST OBTAIN AN AUTHORIZED RETURN (AR) NUMBER FROM OMEGA'S CUSTOMER SERVICE DEPARTMENT (IN ORDER TO AVOID PROCESSING DELAYS). The assigned AR number should then be marked on the outside of the return package and on any correspondence.

The purchaser is responsible for shipping charges, freight, insurance and proper packaging to prevent breakage in transit.

FOR **WARRANTY** RETURNS, please have the following information available BEFORE contacting OMEGA:

1. Purchase Order number under which the product was PURCHASED,
2. Model and serial number of the product under warranty, and
3. Repair instructions and/or specific problems relative to the product.

FOR **NON-WARRANTY** REPAIRS, consult OMEGA for current repair charges. Have the following information available BEFORE contacting OMEGA:

1. Purchase Order number to cover the COST of the repair,
2. Model and serial number of the product, and
3. Repair instructions and/or specific problems relative to the product.

OMEGA's policy is to make running changes, not model changes, whenever an improvement is possible. This affords our customers the latest in technology and engineering.

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- ☒ Cartridge & Strip Heaters
- ☒ Immersion & Band Heaters
- ☒ Flexible Heaters
- ☒ Laboratory Heaters

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- ☒ Refractometers
- ☒ Pumps & Tubing
- ☒ Air, Soil & Water Monitors
- ☒ Industrial Water & Wastewater Treatment
- ☒ pH, Conductivity & Dissolved Oxygen Instruments

M-5300/0613